

Comparability and Integration of State-, Regional-, and National-Scale Probability-Based Surveys

Anthony (Tony) R. Olsen

Aquatic Monitoring and Assessment Branch

Western Ecology Division, NHEERL

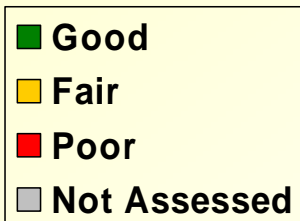
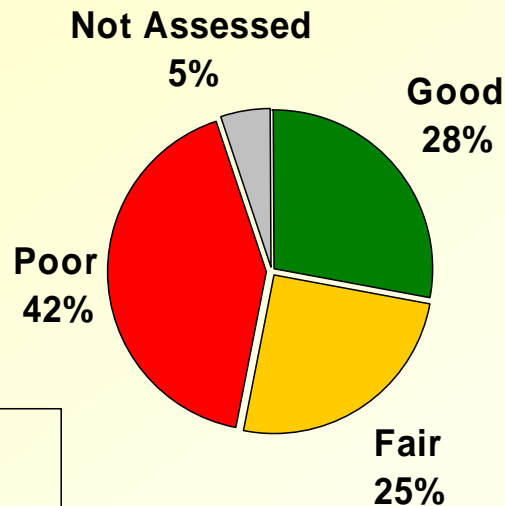
Office of Research and Development

U.S. EPA, Corvallis, OR

Email: olsen.tony@epa.gov

April 25, 2006

Hypothetical National Estimate



The National Lake Assessment found that 28% of lakes in United States are in good condition.



Getting National Assessments Based on State Assessments

$$\hat{L}_{us} = \hat{L}_{al} + \hat{L}_{ar} + \dots + \hat{L}_{wy}$$

$$\hat{P}_{us} = \left(\frac{LF_{al}}{LF_{us}} \right) * \hat{P}_{al} + \left(\frac{LF_{ar}}{LF_{us}} \right) * \hat{P}_{ar} + \dots + \left(\frac{LF_{wy}}{LF_{us}} \right) * \hat{P}_{wy}$$

$$Var(\hat{P}_{us}) = \left(\frac{LF_{al}}{LF_{us}} \right)^2 * Var(\hat{P}_{al}) + \left(\frac{LF_{ar}}{LF_{us}} \right)^2 * Var(\hat{P}_{ar}) + \dots + \left(\frac{LF_{wy}}{LF_{us}} \right)^2 * Var(\hat{P}_{wy})$$

where

\hat{L}_{xx} = estimated number of lakes in "xx" state or U.S.

P_{xx} = estimated proportion of lakes in good condition for "xx" state or U.S.

LF_{xx} = Number of lakes in NHD (sample frame) for "xx" state or U.S.

$Var(\hat{P}_{xx})$ = variance of estimated proportion of lakes in good condition for "xx" state or U.S.



What Can Cause Problems?

- **Objective:** Focus on long-term goal of cost-effective, defensible assessments of lakes at state, tribal, regional, and national scales.
- **Target Population:** Understanding state, tribal, regional, and national lake definitions and impact on design.
- **Sample Frame:** Importance of sample frame development and integrating them across organizations.
- **Survey Design:** Using probability-based survey designs that meet needs at all scales.
- **Response Design:** Incorporating indicators relevant to each organization.
- **Site Evaluation:** Adopting common process useful at all scales.
- **Population Estimation:** Learning how to make lake assessments at all scales compatible.



Target Population Definitions

- Desirable: A single definition that all agree upon: A lake/pond/reservoir is...“set of criteria”
- Necessary:
 - Explicit set of agreed-upon criteria that identifies a lake
 - Documentation by each organization on which criteria used in their definition
 - Lake evaluation information for each lake giving status of lake for each criteria

Possible Definition Criteria

- **Desirable example:** A lake/pond/reservoir is a water body that:
 - is a permanent water body
 - has surface area greater than or equal to 1 hectare
 - is not a saline water body
 - is not used for aquaculture, disposal tailings, sewage treatment, evaporation, or other unspecified disposal use
 - is greater than 1 meter deep
 - has at least 1,000 square meters surface area of open water
- **Criteria example:**
 - permanent versus seasonal water body
 - minimum surface area
 - saline versus non-saline
 - special use water body types
 - minimum depth
 - minimum open water surface area



Why is This Important?

- To compare or combine surveys by different organizations, we must be able to create a lake definition that is common to all.
- National criteria are “lowest common criteria” unless option available to survey lakes not sampled by some states or tribal nations

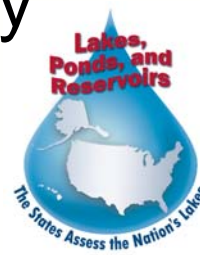


“Lurking” Definition Issue

- Is a lake . . .
 - assessed as a single unit (discrete entity)?
 - assessed separately in different portions of the lake (assessment units)?
 - assessed continuously (areal entity)?
- Can assessments based on discrete entities, assessment units, and areal entities be combined?

Sample Frame Issues

- Sample frame is best GIS representation of lakes that meet the target population definition
- Each organization creates a sample frame that meets their requirements
- When integrating surveys, it is critical that a single combined sample frame be constructed
- Must know if all sample frames include lakes of interest
- Sample frames must have common set of attributes necessary when combined nationally



Survey Design Issues

- Every state and tribal nation either must use a probability-based survey design OR sample every lake within their jurisdiction.
- If national estimate is based on lakes sampled in one year (e.g., 2007),
 - then survey design in each state must cover entire state in 2007
 - *i.e.*, a state using a rotating basin design would not have necessary design for national estimate
- If national estimate is based on data from past 5 years,
 - then rotating basin designs would provide necessary data
- National survey requires estimates by aggregated ecoregions
 - sample size required would need to be assured by collection of state sample sizes



Response Design Issues

- Does definition of “good” condition mean the same thing for all states?
- Do states measure a core set of indicators that are required for national estimates?
- Are indices, such as IBI, calculated the same?
- Do states use same field and lab protocols for an indicator?



Site Evaluation Issues

- **Because sample frames based on NHD are not perfect lists for all lakes in target population, some lakes selected will not be sampled**
 - Are states keeping track of why a lake was not sampled?
 - Are states using same, or comparable, information to make a decision not to sample?
- **Some lakes require land owner permission to sample**
 - Are states using similar procedures to gain access?
 - Are the procedures designed to minimize access denials?
- **Some lakes are physically unsafe or difficult to access**
 - Are states using similar procedures/effort to get access?
 - Access is more difficult in some states (e.g., Alaska) than others. How does this impact national estimates?



Population Estimation Issues

- Integrating data from state surveys is an information management task
 - What information is required to do national estimates?
 - When is the information required?
- How are national estimates produced
 - Aggregation of state-level estimates?
 - Estimates based on state-level data?



Fundamental Design Options

- National-level survey design with provision for 50 state-level intensifications
- 50 state-level survey designs that are coordinated to ensure national estimates
- Near-term national-level survey design necessary
- Long-term objective is integrated state-level and national-level survey design




http://www.epa.gov/nheerl/arm

Aquatic Resource Monitoring - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Forward Stop Home Search Favorites Mail Print Word Pad Internet Options

Address <http://www.epa.gov/nheerl/arm/> Go Links

 **U.S. Environmental Protection Agency**


Aquatic Resources Monitoring

[Recent Additions](#) | [Contact Us](#) | [Print Version](#) | [Search](#)

[EPA Home](#) > [Office of Research Development \(ORD\)](#) > [National Health Environmental Effects Research Laboratory \(NHEERL\)](#) > [Western Ecology Division \(WED\)](#) > ARM

Aquatic Resources Monitoring Web Site

Hosted by the
Monitoring Design and Analysis Team
USEPA ORD
National Health and Environmental Effects Research Laboratory,
Western Ecology Division,
Corvallis, OR



Environmental Monitoring and Assessment Program

This Web site provides information on monitoring of aquatic resources in the US, primarily focused on design and analysis of probability based surveys. Links are provided to other aquatic resources monitoring information available on the internet.

ARM is designed to provide users needing information in several areas:

1. [Introductory, conceptual and overview](#) information on the overall approach, concepts and benefits.
2. [Program level](#) information on details of the approach, requirements, alternatives and examples.
3. [Technical level](#) information on the design and analysis details, including access to example data sets, results and statistical algorithms.
4. [Implementation](#) Issues, Indicators, and Field Manuals
5. [Presentation](#) and training materials
6. [Reference](#) information, internet links, brief descriptions of Federal, State, Tribal monitoring and research programs on aquatic resource monitoring.
7. [Related publications and documents](#) and [program links](#).

Check out [Current Events and Related Information](#). For Navigational Hints visit the [Site Map](#)

Aquatic Resource Monitoring

- Site Map
- Recent Additions
- Introduction
- Design & Analysis
- Process Overview
- Design: How to
 - GRTS Designs
- Analysis: How to
- Download Software
- Aquatic Resources
 - Estuaries
 - Lakes
 - Streams
 - Wetlands
 - Great Rivers
- Indicators
- Monitoring Programs
- Office Water

Local intranet

